

References for Arsenic and Lead Dermal Exposure

Arsenic

1. Cal/EPA – OEHHHA: http://oehha.ca.gov/air/hot_spots/pdf/ArsenicPR.pdf

While absorption from the gastrointestinal tract is the most important route of exposure for waterborne arsenic, some potential for dermal absorption has been reported. Rahman et al. (1994) conducted in vitro studies with sodium [74As] arsenate and clipped full-thickness mouse skin in a flow-through system. Doses of 5, 50, 500, or 5000 ng were applied to 0.64 cm² of skin as a solid, in aqueous vehicle, or in soil.

Absorption of sodium arsenate increased linearly with applied dose from all vehicles. The maximum absorption of 62 percent of applied dose was obtained with the aqueous vehicle and the least (0.3 percent) with soil. Wester et al. (1993) evaluated the percutaneous absorption of [73As] arsenate from soil or water in vivo in Rhesus monkeys and in vitro in human cadaver skin. Water solutions of [73As] arsenate at low (0.024 ng/cm²) or high (2.1 µg/cm²) surface concentrations were compared. With topical administration for 24 hr, in vivo absorption in the Rhesus monkey was 6.4 ± 3.9 (SD) percent from the low dose and 2.0 ± 1.2 (SD) percent from the high dose. In vitro percutaneous absorption of the low dose from water in human skin was 0.93 ± 1.1 percent in receptor fluid and 0.98 ± 0.96 percent in the washed skin; the total was about 1.9 percent. Absorption from soil (0.4 ng/cm²) was less, at 6.4 percent in the monkey in vivo and 0.8 percent in human skin in vitro.

2. CDC/ATSDR: <http://www.atsdr.cdc.gov/phs/phs.asp?id=18&tid=3#bookmark04>

If you get arsenic-contaminated soil or water on your skin, only a small amount will go through your skin into your body, so this is usually not of concern.

3. Michigan Department of Environmental Quality: https://www.michigan.gov/documents/deq/deq-wd-gws-wcu-arsenicwellwater_270592_7.pdf

Arsenic is not readily absorbed by the skin, so contact with water (showering, laundering, washing dishes, etc.) is not a significant risk.

4. New Jersey Department of Environmental Protection: <http://www.state.nj.us/dep/dsr/research/dermal-arsenic-whitepaper.pdf>

In summary, the literature on dermal absorption of inorganic arsenic from water is quite limited. The laboratory studies suggest that dermal absorption does occur to some extent. In vivo results from the species tested which is most relevant to humans, Rhesus monkeys, as well as the in vitro studies from human cadaver skin, give similar absorption rates, and suggest that the rate of absorption is low. In contrast, in vivo results from the rat and in vitro data from the mouse gave rates of absorption about 10-fold higher. Estimates of potential dermal absorption through bathing indicate that exposure is less than 1% of that received through drinking water, even when the higher rodent dermal absorption data, which is less likely to be relevant to humans are used. If the data from Rhesus monkeys and human cadaver skins are used, the estimates of dermal absorption will be about ten times lower. The limited data from individuals using high arsenic water for bathing and other household uses while drinking bottled water do not demonstrate detectable absorption of arsenic from bathing. The National Research Council (1999) evaluated the available information on this subject and stated that “these results indicate a low degree of systemic absorption of arsenic via the skin.” ATSDR (2000) concluded that “it is usually considered that dermal uptake of arsenates

and arsenites is sufficiently low that this route is unlikely to be of health concern ..., but studies to test the validity of this assumption would be valuable.”

Lead

1. CDC/ATSDR: <http://www.atsdr.cdc.gov/csem/csem.asp?csem=7&po=6>

In the U.S. the public is not likely to encounter lead that readily enters the human body through the skin (dermal exposure), as leaded gasoline additives are no longer used.

Dermal exposure plays a role for exposure to organic lead among workers, but is not considered a significant pathway for the general population.

- Organic lead may be absorbed directly through the skin.
- Organic lead (tetramethyllead) is more likely to be absorbed through the skin than inorganic lead.
- Dermal exposure is most likely among people who work with lead.

2. CDC/NCEH: <http://www.cdc.gov/nceh/lead/tips/water.htm>

If my water has high lead levels, is it safe to take a bath or shower?

Yes. Bathing and showering should be safe for you and your children, even if the water contains lead over EPA's action level. Human skin does not absorb lead in water.

3. OSHA: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10031

Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin.

4. Washington State Department of Ecology:
http://www.ecy.wa.gov/programs/tcp/SAB/SAB_mtg_info/Mtg_040528/SABMayMeetingOutline.pdf

Ecology continues to believe that exposure from dermal contact with lead contaminated soils is a small contributor to overall lead exposure. However, Ecology agrees that a more explicit discussion of this pathway should be included in future discussions of uncertainty and variability.